

Alabama, 25. Arizona, 1, 2, 8, 15, 18, 19, 20, 23. Arkansas, 2, 14, 16, 17, 18, 19, 20, 21, 25, 31. California, 4, 18. Connecticut, 17, 26. Delaware, 20, 26. Georgia, 5, 14, 25, 26. Idaho, 15. Illinois, 2, 3, 4, 5, 6, 10, 13, 14, 16, 17, 19, 20, 25, 28, 30, 31. Indiana, 1, 2, 3, 4, 5, 13, 17, 19, 20. Iowa, 3, 4, 6, 7. Kansas, 2, 3, 4, 6, 9, 12, 13, 16, 17, 18, 19, 20, 27. Kentucky, 2, 3, 4, 14, 16, 17, 18, 19, 20, 21, 24, 30, 31. Louisiana, 3, 4, 18, 19, 23, 24. Maine, 14, 21. Maryland, 3, 4, 20, 22, 26. Massachusetts, 17, 31. Michigan, 4, 5, 6, 13, 14, 20, 29, 30. Minnesota, 6, 7, 11, 15. Mississippi, 4, 17, 18, 19, 21, 25, 26, 27. Missouri, 2, 3, 4, 5, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 25, 29, 30, 31. Montana, 14, 15, 23, 25. Nebraska, 20, 27, 30. Nevada, 2, 6, 7, 8, 10, 11, 18, 19. New Hampshire, 12, 14, 21. New Jersey, 3, 4, 8, 9, 15, 20, 21, 22, 23, 26, 30, 31. New York, 4, 5, 6, 7, 13, 14, 17, 20, 26, 30. North Carolina, 20, 21, 25, 26, 29, 30, 31. North Dakota, 4, 5, 7, 11, 12, 29, 30. Ohio, 2, 3, 4, 5, 7, 17, 20, 21, 22, 25, 29, 30, 31. Oklahoma, 2. Oregon, 1, 4, 5, 9, 17, 24. Pennsylvania, 3, 4, 5, 17, 19, 20, 21, 26, 31. South Carolina, 25. South Dakota, 4, 5, 10, 12, 13. Tennessee, 2, 4, 5, 14, 15, 17, 18, 19, 20, 21, 25, 26, 31. Texas, 2, 3, 4, 16, 17, 18, 19, 20, 21. Utah, 8, 12, 14. Vermont, 14, 15, 17, 18. Virginia, 2, 19, 20, 25, 26, 27, 28, 29. Washington, 4, 15, 16, 25, 26. West Virginia, 19, 20, 29, 31. Wisconsin, 3, 4, 5, 6, 12, 13, 28.

#### WIND.

The prevailing winds for December, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The resultant winds, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

Maximum wind velocities are given in Table I, which also gives the altitudes of Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				Miles	
Amarillo, Tex. ....	12	56	n.	Fort Canby, Wash. ....	31	50	e.
Do. ....	18	54	nw.	Carson City, Nev. ....	6	57	sw.
Do. ....	15	54	w.	Do. ....	7	56	w.
Block Island, R. I. ....	14	54	e.	Cheyenne Wyo. ....	7	50	w.
Buffalo, N. Y. ....	5	60	w.	Chicago, Ill. ....	16	56	sw.
Do. ....	16	51	w.	Do. ....	29	56	sw.
Do. ....	29	53	w.	Cleveland, Ohio. ....	23	56	nw.
Do. ....	30	53	w.	Do. ....	24	50	nw.
Fort Canby, Wash. ....	4	78	se.	Denver, Colo. ....	7	53	w.
Do. ....	6	86	s.	Do. ....	30	52	w.
Do. ....	7	84	s.	Havre, Mont. ....	26	60	nw.
Do. ....	8	63	s.	Sioux City, Iowa. ....	15	51	nw.
Do. ....	10	54	se.	Do. ....	16	53	nw.
Do. ....	13	75	se.	Tatoosh Island, Wash. ....	6	60	e.
Do. ....	23	60	s.	Do. ....	13	54	w.
Do. ....	24	59	s.	Do. ....	27	53	s.
Do. ....	25	60	se.	Do. ....	30	55	e.
Do. ....	26	73	s.	Do. ....	31	63	e.
Do. ....	27	73	s.	Woods Hole, Mass. ....	18	54	nw.
Do. ....	28	60	s.	Do. ....	24	50	w.

#### ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the

number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

**Thunderstorms.**—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 9th, 27; 10th, 24; 13th, 30.

Reports were most numerous from: Louisiana, 26; Mississippi and Missouri, 15; Oregon, 24.

Thunderstorm days were most numerous in: Alabama, Missouri, and Oregon, 5; Louisiana, 12; Mississippi, 7.

**In Canada.**—Professor Stupart reports thunderstorms as follows: at Bermuda on the 15th.

**Auroras.**—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 4th to the 12th, inclusive. On the remaining twenty-two days of this month 128 reports were received, or an average of about 6 per day. The dates on which the number of reports of auroras for the whole country especially exceeded this average were: 20th, 40; 21st, 27.

Reports were most numerous from: Illinois, 11; Minnesota and Montana, 20; North and South Dakota, respectively, 10.

The number of reports was a large percentage of the number of observers in: Minnesota, 29; Montana, 54; North Dakota, 20; and South Dakota, 23.

**In Canada.**—Professor Stupart reports auroras on the following dates: Father Point, 20, 21, 28, 29; Winnipeg, 20, 31; Minnedosa, 1, 15, 17, 18, 20, 21, 22, 29; Qu'Appelle, 30, 31; Medicine Hat, 10, 20, 22, 23, 26, 28, 30; Swift Current, 22; Prince Albert, 2; Edmonton, 20; Battleford, 2, 4, 15, 29, 30, 31.

#### SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic, and at 47 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table X for the stations at which instrumental self-registers are maintained.

#### COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the durations of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentages of area of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely.

For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for December, 1897, is 5 per cent for photographic and 4 per cent for thermometric records.

The details are shown in the accompanying table, in which the stations are arranged according to the *total possible* duration of sunshine, and not according to the *observed* duration. In obtaining the total possible sunshine the value for the parallel of latitude nearest the station is used.

*Difference between instrumental and personal observations of sunshine.*

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
Key West, Fla.	24 34	T.	329.1	55	57	2	58	+15
Tampa, Fla.	27 57	T.	322.9	57	57	0	58	+1
Galveston, Tex.	29 18	P.	330.2	42	44	+2	55	0
New Orleans, La.	29 58	T.	317.8	55	55	0	60	+10
Jacksonville, Fla.	30 20	T.	317.8	50	49	+1	59	+2
Savannah, Ga.	32 05	P.	318.0	44	49	+5	39	+2
Vicksburg, Miss.	32 23	T.	318.0	37	38	+1	41	-2
San Diego, Cal.	32 43	P.	310.7	79	88	+9	33	+5
Charleston, S. C.	32 47	T.	310.7	49	47	+2	48	+3
Phoenix, Ariz.	33 28	P.	310.7	74	87	+13	41	+12
Atlanta, Ga.	33 45	T.	307.7	28	29	+1	25	-1
Los Angeles, Cal.	34 08	P.	307.7	79	85	+6	41	+12
Wilmington, N. C.	34 14	T.	307.7	45	45	0	48	+3
Little Rock, Ark.	34 45	T.	305.2	29	29	0	41	+12
Chattanooga, Tenn.	35 04	T.	305.2	26	26	0	25	-1
Oklahoma, Okla.	35 26	T.	305.2	54	54	0	58	+4
Santa Fe, N. Mex.	35 41	P.	302.5	72	81	+9	41	+1
Raleigh, N. C.	35 45	T.	302.5	40	40	0	31	+5
Knoxville, Tenn.	35 56	T.	302.5	26	26	0	27	+6
Nashville, Tenn.	36 10	T.	302.5	21	21	0	72	+5
Fresno, Cal.	36 43	T.	299.4	67	67	0	71	+16
Dodge City, Kans.	37 45	P.	296.7	64	71	+7	24	+7
San Francisco, Cal.	37 48	T.	296.7	55	55	0	71	+16
Louisville, Ky.	38 15	T.	296.7	17	17	0	24	+7

*Difference between instrumental and personal observations—Cont'd.*

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
St. Louis, Mo.	38 38	T.	293.7	19	19	0	29	+10
Washington, D. C.	38 54	P.	293.7	51	50	-1	29	0
Kansas City, Mo.	39 05	P.	293.7	30	36	+6	19	+2
Cincinnati, Ohio	39 06	T.	293.7	29	29	0	35	+6
Parkersburg, W. Va.	39 16	T.	293.7	17	17	0	19	+2
Baltimore, Md.	39 18	T.	293.7	42	42	0	54	+12
Atlantic City, N. J.	39 22	P.	293.7	39	49	+10	22	+3
Denver, Colo.	39 45	P.	291.7	55	68	+13	49	+16
Indianapolis, Ind.	39 46	T.	291.7	19	19	0	15	-6
Philadelphia, Pa.	39 57	T.	291.7	33	33	0	41	+14
Columbus, Ohio	39 58	T.	291.7	31	31	0	16	0
Harrisburg, Pa.	40 16	T.	291.7	27	27	0	46	+8
Pittsburg, Pa.	40 32	T.	287.8	16	16	0	16	0
New York, N. Y.	40 43	T.	287.8	38	38	0	46	+8
Salt Lake City, Utah	40 46	P.	287.8	50	48	-2	46	+8
Eureka, Cal.	40 48	P.	287.8	49	53	+4	46	+8
Cheyenne, Wyo.	41 08	P.	287.8	51	59	+8	46	+8
Omaha, Nebr.	41 16	P.	287.8	37	38	+1	46	+8
Cleveland, Ohio	41 30	T.	284.7	9	9	0	46	+8
Des Moines, Iowa	41 35	T.	284.7	49	49	0	46	+8
Chicago, Ill.	41 53	T.	284.7	31	31	0	46	+8
Erie, Pa.	42 07	T.	284.7	18	18	0	46	+8
Binghamton, N. Y.	42 08	T.	284.7	23	23	0	46	+8
Detroit, Mich.	42 20	T.	284.7	29	29	0	46	+8
Boston, Mass.	42 21	T.	284.7	36	36	0	46	+8
Dubuque, Iowa	42 30	T.	284.7	41	41	0	46	+8
Albany, N. Y.	42 39	T.	281.0	23	23	0	46	+8
Buffalo, N. Y.	42 53	T.	281.0	12	12	0	46	+8
Yankton, S. Dak.	42 54	T.	281.0	41	41	0	46	+8
Rochester, N. Y.	43 08	T.	281.0	12	12	0	46	+8
Idaho Falls, Idaho*	43 29	T.	281.0	34	34	0	46	+8
Portland, Me.	43 39	T.	277.7	35	35	0	46	+8
Northfield, Vt.	43 10	P.	277.7	28	29	+1	46	+8
Huron, S. Dak.	44 21	T.	277.7	37	37	0	46	+8
Eastport, Me.	44 54	P.	274.3	32	39	+7	46	+8
St. Paul, Minn.	44 58	P.	274.3	44	42	-2	46	+8
Minneapolis, Minn.	44 59	T.	274.3	35	35	0	46	+8
Portland, Oreg.	45 32	P.	269.6	28	28	0	46	+8
Helena, Mont.	45 32	P.	269.6	28	28	0	46	+8
Blairmont, N. Dak.	46 47	P.	265.6	39	38	-1	46	+8
Tacoma, Wash.	47 16	T.	265.6	18	18	0	46	+8
Seattle, Wash.	47 38	T.	262.1	19	19	0	46	+8
Spokane, Wash.	47 40	T.	262.1	17	17	0	46	+8

\*Instrument out of order.

## CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Snowfall and rainfall are expressed in inches.

**Alabama.**—The mean temperature was 47.8°, or 0.8° above normal; the highest was 82°, at Eufaula on the 5th, and the lowest, 19°, at Hamilton on the 31st. The average precipitation was 5.82, or 2.20 above normal; the greatest monthly amount, 12.13, occurred at Jasper, and the least, 1.05, at Clanton.—*F. P. Chaffee.*

**Arizona.**—The mean temperature was 43.5°, or 9.5° below normal; the highest was 89°, at Maricopa, and the lowest, 12° below zero at Williams. The average precipitation was 0.42, or 0.06 above normal; the greatest monthly amount, 1.50, occurred at Flagstaff, while none fell at Calabasas, Casa Grande, Fort Mohave, and Gila Bend.—*W. T. Blythe.*

**Arkansas.**—The mean temperature was 40.4°, or 3.1° below normal; the highest was 81°, at Bee Branch on the 9th, and the lowest, 10°, at Dallas, Fayetteville, and Winslow on the 4th. The average precipitation was 6.00, or 1.35 above normal; the greatest monthly amount, 9.11, occurred at Blanchard, and the least, 2.74, at Dardanelle.—*F. H. Clarke.*

**California.**—The mean temperature was 44.4°, or 8.5° below normal; the highest was 94°, at Downey on the 23th, and the lowest, 20° below zero, at Bodie on the 20th. The average precipitation was 1.75, or 2.67 below normal; the greatest monthly amount, 10.66, occurred at Crescent City, while none fell at several stations.—*H. W. Hammon.*

**Colorado.**—The mean temperature was 23.1°, or 3.2° below normal; the highest was 74°, at Rockyford on the 8th, and the lowest, 33° below zero, at Steamboat Springs on the 20th. The average precipitation was 0.90, or 0.18 below normal; the greatest monthly amount, 5.75, occurred at Ruby, and the least, 0.05, at Vilas.—*F. H. Brandenburg.*

**Florida.**—The mean temperature was 60.4°, or slightly above normal; the highest was 91°, at Lemon City on the 9th, and the lowest, 28°, at De Funiak Springs on the 5th, at Perry on the 27th and 28th, and at Wausau on the 6th. The average precipitation was 2.84, or about 0.50 above normal; the greatest monthly amount, 6.50, occurred at Carrabelle, and the least, 1.00, at Lemon City.—*A. J. Mitchell.*

**Georgia.**—The mean temperature was 48.4°, or 1.1° above normal; the highest was 84°, at Bragg on the 4th and 11th, and the lowest, 18°, at Toccoa on the 24th. The average precipitation was 3.66, or 0.58 below normal; the greatest monthly amount, 7.97, occurred at Diamond, and the least, 1.51, at Talbotton.—*J. B. Marbury.*

**Idaho.**—The mean temperature was 24.5°; the highest was 57°, at Idaho City on the 29th, and the lowest, 27° below zero, at Gray on the 18th. The average precipitation was 2.08; the greatest monthly amount, 6.49, occurred at St. Maries, and the least, 0.58, at Rexburg.—*D. P. McCallum.*

**Illinois.**—The mean temperature was 27.3°, or 2.4° below normal; the highest was 72°, at Albion on the 10th, and the lowest, 18° below zero, at Scales Mound on the 18th. The average precipitation was 2.38, or 0.07 below normal; the greatest monthly amount, 5.15, occurred at Cobden, and the least, 0.84, at Sycamore.—*C. E. Linney.*

**Indiana.**—The mean temperature was 31.6°, or 1.6° below normal; the highest was 70°, at Boonville on the 9th, and at Vevay and Washington on the 10th, and the lowest, 9° below zero, at Topeka on the 24th. The average precipitation was 2.65, or 0.14 below normal; the greatest